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FEDERAL GUIDELINES - DESIGN, OPERATION AND MAINTENANCE OF WASTE WATER TREATMENT FACILITIES

Federal Water Quality Administration
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Federal Guidelines

Design, Operation and Maintenance

of Waste Water Treatment Facilities

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of Waste Water Treatment Facilities

September 1970

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U.S. DEPARTMENT OF THE INTERIOR • FEDERAL WATER QUALITY ADMINISTRATION

FOREWORD

Effective design and operation of municipal waste water treatment facilities is an essential element in the preservation and enhancement of our Nation's waters. The tremendous investment of Federal, State, and local funds in these facilities must be protected. We must incorporate past experience and new technology in this generation of facilities co ensure that optimum benefits are derived from expenditures in water pollution control. The development of these Guidelines represents a significant step toward the achievement of these goals.

Many have contributed to the development of these Guidelines. I particularly wish to thank the Ad Hoc Advisory Group, composed of representatives of the American Society of Civil Engineers, the Association of Metropolitan Sewerage Agencies, the Association of State and Interstate Water Pollution Control Administrators, the Great Lakes-Upper Mississippi Board of Sanitary Engineers, the U. S. Council of Consulting Engineers, the Water and Wastewater Equipment Manufacturers' Association, and the Water Pollution Control Federation, for their advice and counsel in reviewing the Guidelines and in developing the general procedures.

David D. Dominick

David D. Dominick, Commissioner
Federal Water Quality Administration

TABLE OF CONTENTS

FOREWORD 1

INTRODUCTION 1

GUIDELINES FOR DESIGN 5

A. Preliminary Project Planning and Engineering Report 7

environmental compatibility
regionalization
project feasibility
complete and operable treatment works
ultimate disposal of sludge and solids
treatment plant reliability
excessive infiltration
elimination of by-passing
industrial wastes
staffing and budget for a facility
design period
combined sewerage systems

B. Preparation of Plans and Specifications 18

design summary
reliability
discharges to shellfish, potable or recreational waters
elimination of by-passes and overflows
treatment during construction
experimental processes or equipment
flexibility and ease of operation and maintenance
protection of effluent quality
safety features
interceptor sewers
general requirements

GUIDELINES FOR OPERATION AND MAINTENANCE 31

A. Federal and State Inspections 31

B. Personnel 35

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C. Records, Reports, and Laboratory Control 37

D. Process Control 39

APPENDIX

Suggested Guide for an Operation and Maintenance Manual 42

INTRODUCTION

Over the past year the Federal Water Quality Administration has carefully analyzed and evaluated its grant program for the construction of waste treatment facilities. Past experience indicated that some of the projects that have received assistance have, for a variety of reasons, not always been as successful as anticipated. Improved design practices and technological advances are not being adequately incorporated into new plants. Operators are often poorly trained and paid. Facilities are frequently badly maintained and achieve far less than their designed efficiency levels.

FWQA has an obligation to ensure that Federal monies are wisely spent. This Administration must insist on proper design and operation procedures as it is clear that without them adequate levels of treatment will not be obtained.

On February 10, 1970, President Nixon announced a 37 point program to improve the Federal government's environmental protection programs. In this message he directed the Secretary of the Interior to require that Federally-assisted treatment facilities meet prescribed design, operation and maintenance standards. Only July 2, 1970, the Department of the Interior issued new regulations for the

construction grants program to implement the President's directive. Section 601.35 of Title 18 of the Code of Federal Regulations concerns the area of operation and maintenance of facilities; Section 601.36 concerns the design of facilities.

Section 601.36 states that "no grant shall be made for any project unless the Commissioner determines that the proposed treatment works are designed so as to achieve economy, efficiency, and effectiveness in the prevention or abatement of pollution or enhancement of the quality of the water into which such treatment works will discharge and meet such requirements as the Commissioner may publish from time to time concerning treatment works design so as to achieve efficiency, economy and effectiveness in waste treatment."

There are existing manuals, such as the various State and interstate standards and the ASCE-WPCF manuals, which can be used as references in the design of water pollution control facilities. Although these are generally adequate, it is important to emphasize that FWQA is not necessarily in full agreement with all criteria and concepts contained therein. Certain design considerations are not adequately emphasized, and adequate guidance is not given in those areas where there have been recent technological advances.

To supplement the existing standards, FWQA has developed Guidelines for Design. These Guidelines are not intended to cover all aspects of engineering design. Rather they outline, generally in broad terms, specific FWQA interests and policies that are not adequately reflected in the presently existing manuals.

In addition to these Guidelines, FWQA will be issuing Technical Bulletins. Each Bulletin will cover a certain topic in detail. These Bulletins are intended to amplify specific areas contained in the Guidelines, define and analyze certain deficiencies in design, and evaluate new advances in technology and provide guidance for incorporating these in new facilities. The Bulletins will combine the results of our field experience and our research and development program, along with the efforts of outside experts and consultants.

Together with the applicable portions of presently existing manuals and the attached Guidelines, the Technical Bulletins will cummulatively constitute the FWQA design requirements referred to in Section 601.36.

Section 601.35 states that "no grant shall be made for any project unless the State water pollution control agency assures the Commissioner that the State will inspect the treatment works not less frequently than annually for the 3 years after such treatment works are constructed and periodically thereafter to determine whether such treatment works are operated and maintained in an efficient, economic, and effective manner and unless the applicant assures the Commissioner that the treatment works will be maintained and operated in accordance with such requirements as the Commissioner may publish from time to time concerning methods, techniques, and practices for economic, efficient, and effective operation and maintenance of treatment works."

The number and frequency of the inspections called for by the regulation are the absolute minimum necessary to ensure proper maintenance and operation of a facility. FWQA will be working closely with the States to ensure that inspections are adequate in scope as well as in frequency.

FWQA has developed Guidelines for Operation and Maintenance which provide the general basic requirements in the areas of inspections, operation and maintenance for Federally-assisted projects. FWQA will be issuing Technical Bulletins which, as in the case of the Technical Bulletins for Design, will provide amplifications in certain specific areas.

The Guidelines and future FWQA Technical Bulletins for design and operation and maintenance should be maintained in appropriate files by State water pollution control agencies, consulting engineers, and all other interested parties. In the future, projects for which Federal grant assistance is requested are expected to comply with these Guidelines and Technical Bulletins. While in exceptional cases deviations may be accepted, any deviations must be justified on a case-by-case basis and approved by FWQA prior to their initiation.

GUIDELINES FOR DESIGN

These Guidelines are intended to supplement existing references such as the Recommended Standards for Sewage Works: Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (the Ten State Standards), the ASCE Manuals Number 36 and 37 (WPCF Manuals 8 and 9), and applicable State standards and guidelines.

All water pollution control projects which are submitted for FWQA construction grants will be required to conform to these Guidelines and future Technical Bulletins, as well as to applicable State requirements. It is recognized that certain modifications or exceptions may be necessary when justified in unusual situations. In such cases under appropriate conditions, dev'ations from existing standards or Guidelines may be allowed. However, written approval of any deviations from the Guidelines, Technical Bulletins, or applicable State standards must be obtained from the FWQA Regional Office and the State agency as early as possible prior to the completion of detailed plans and specifications.

These Guidelines are presented in two parts. Part A deals with general concepts which must be considered very early in the planning and preparation of an engineering report for waste

treatment facilities. Part B makes reference to more specific subjects which must be considered in the preparation of final construction plans and specifications.

A. PRELIMINARY PROJECT PLANNING AND ENGINEERING REPORT

Certain basic principles should be considered early in the planning process for water pollution control facilities. Conformance with these principles is essential to ensure the eventual development of properly designed facilities which will meet all State and FWQA requirements.

The engineering report accompanying the application for Federal aid should clearly indicate compliance with the following principles. Any questions regarding the applicability of these items to the proposed project or requests for deviations should be resolved by consultation with the State water pollution control agency and the FWQA Regional Office before completion of the engineering report and submission of an application for Federal aid.

I. Environmental Compatibility

All Federally-assisted projects must conform to the intent of the National Environmental Policy Act of 1969 and Executive Order 11514, Protection and Enhancement of Environmental Quality.

a. Planning for the proposed project must take into account all aspects of environmental quality protection. Efforts shall be taken to preserve natural beauty, wildlife, recreational areas, historic sites, and private property.

b. The project must be designed and constructed so as to have the least possible impact on the environment.

c. Attention must be given to the general aesthetic appearance of the facility and to the prevention of any possible odor problems.

d. Planning shall be coordinated with local planning and citizen groups to resolve potential site problems.

e. Plant locations on flood plains should be avoided whenever practicable. When such locations are unavoidable, adequate protection from flooding must be provided.

II. Regionalization

a. Due consideration must be given to the advantages of regional and basin sewerage facility planning. Whenever feasible, municipalities should join together in cooperative regional treatment systems, composed of one or more treatment plants depending on water quality requirements and economic, operational, and other appropriate considerations.

b. Where regional waste water management plans have been developed and approved by an appropriate agency, the project should conform to such plans.

c. If a regional plan has not been developed, an analysis shall be made to determine the feasibility of having the municipality join in a regional system in lieu of constructing their own independent or additional treatment facilities.

III. Project Feasibility

a. After consideration of all alternatives, the design of the proposed project shall be made on the basis of economic feasibility, water quality objectives, environmental compatibility, and other applicable considerations. That certain portions of the system are eligible for Federal assistance and others are not should not determine the final nature of the project.

b. In order to avoid tying up Federal grant funds for unreasonably long periods of time, the project for which Federal aid is requested, including other facilities required to make it operable, should be of such a scope that it can be completed and in operation within three years of the date of the Federal grant offer. For unusually large and complex projects, a longer period of time may be allowed. Additional phases of the project may be submitted for consideration for Federal aid in future years when the anticipated construction period will meet these requirements.

IV. Complete and Operable Treatment Works

a. Any proposed project must be designed and reviewed in light of the entire waste treatment system. No project will be approved unless it is shown that the capacity and treatment provided by the waste treatment system serving the proposed project will meet all FWQA, State, and interstate requirements, including approved water quality standards, and protect the designated uses of the receiving waters.

b. If construction of other facilities is required to make the proposed project operable and acceptable, then a commitment must be made that the required construction will be concurrent with that of the proposed facility.

V. Receiving Waters and Degree of Treatment

a. Proposed treatment must be in accordance with State requirements, as well as with Federal and State water quality standards, Federal Enforcement Conference requirements, comprehensive river basin reports and plans, FWQA Regulations, and the designated uses of the receiving waters.

b. Characteristics of receiving waters must be considered to ensure that water quality standards will be met by the proposed treatment. Applicable data shall be included in the engineering report.

c. The engineering report shall specifically indicate the anticipated removal efficiency of BOD, suspended solids, and other appropriate parameters, and the total pounds of BOD, suspended solids, and other significant constituents to be discharged per day.

d. There should be no discharge of effluents to swamps, stagnant waters, small lakes, or intermittent streams if feasible alternates are available.

e. Outfalls shall be extended and designed as necessary to insure adequate mixing and dispersal of the effluent.

f. Disposal of a treated effluent to other than surface waters requires prior approval from the State and FWQA.

VI. Ultimate Disposal of Sludge and Solids

a. Provision for ultimate disposal of sludge must be clearly indicated and must be in accordance with interstate, State, and FWQA requirements. It is not sufficient merely to indicate such processes as drying beds, vacuum filters, or incinerators, without also describing the method to be used for final disposal of the sludge cake or sludge residues.

b. The method of final disposal must not result in any significant degradation of surface or ground water, air, or land resources. If there is a choice, the method

chosen must be that having the least impact on the environment.

c. No sludge residues, grit, ash, or other solids may be discharged into the receiving waters or plant effluent. The disposal of any sludge to ocean waters is not recommended.

d. Disposal of raw sludge to fresh or marine waters or by spreading and tilling on land will not be approved.

e. Sludge elutriation is not considered desirable and will not be approved without adequate safeguards.

VII. Treatment Plant Reliability

a. All water pollution control facilities should be planned and designed so as to provide for maximum reliability at all times.

b. The facility should be capable of operating satisfactorily during power failures, flooding, peak loads, equipment failure, and maintenance shutdowns. A minimum of primary treatment should be provided at all times. Disinfection and higher degrees of treatment may be required where necessitated by the uses of the receiving waters.

c. Such reliability can be obtained through the use of various design techniques which will result in a facility which is virtually "fail-safe." (See Part B, Section II, page 20.)

VIII. Excessive Infiltration

a. Excessive infiltration is an indication of deficiencies in the sewerage system. This situation is often categorized by high per capita flows to the treatment facility.

b. Construction of treatment facilities with extra capacity to handle these excessive flows may not be the best solution to the problem, since this may result in unnecessary capital and operating costs and in inefficient treatment.

c. An analysis of the sewerage system must be made to determine the causes for such excessive infiltration where it occurs and, where feasible, an acceptable remedial plan of action should be prepared to correct the situation.

d. Solutions, such as separation of illegal storm water connections, repair or replacement of defective sewers, and enforcement of sewer ordinances, must be discussed in the report together with an adequate cost analysis

before any recommendation is made to construct an oversized treatment facility or to allow by-passing of excess flows.

IX. Elimination of By-passing

a. In systems handling only dry-weather flows, the incorporation in the design of mechanisms for by-passing treatment plants or pumping stations must be avoided if at all possible. Any exceptions must have prior approval of the State and FWQA.

b. Where incorporation of by-passing facilities is necessary, consideration must be given to separation of combined systems, detention facilities, or other alternative means of control or treatment, and disinfection of overflows.

c. Adequate safeguards to prevent misuse of by-pass facilities must be provided.

d. Extended by-passing during construction will not be permitted. (See Part B, Section IV, page 21.)

X. Industrial Wastes

a. The engineering report should clearly define the characteristics of the wastes from major or significant industries and their effects upon the waste treatment process.

b. Where necessary, pilot plant studies should be made to determine the final design criteria for the treatment facility.

c. It is necessary that adequate industrial waste ordinances or other controls be adopted by the municipalities in order to protect and maintain the treatment facilities. These shall provide for the following:

1. Pretreatment of any wastes which would otherwise be detrimental to the collection system, treatment facilities, or processes.

2. An equitable system of cost recovery in accordance with Federal Regulations, 18 CFR 601.34c.

XI. Staffing and Budget for a Facility

A thorough analysis must be made of the operation and maintenance requirements of the proposed facility, including required laboratory testing. Specific recommendations shall be given in the engineering report for staffing, including operator qualifications, and annual budget needs of the proposed treatment facility.

XII. Design Period

A careful review of the growth potential of the area to be served by a waste water facility should be made to adequately provide for the increased waste loadings that are expected to develop. Both domestic and industrial loadings should be discussed in the report. It is not considered feasible for FWQA to establish a standard minimum design period because the growth characteristics of a particular area may be such that a minimum design period would cause uneconomical design and inefficient operating conditions after the project is constructed The rationale for design will be as follows:

a. When rapid growth is anticipated, the design period should be long enough for orderly spacing of construction contracts and the design should permit sufficient flexibility to prevent inefficient operation of individual units. The design layout of a treatment facility should consider the ultimate development of the watershed being served and the characteristics of the receiving waters. Construction may be phased to meet treatment demands.

b. Where the anticipated growth of an area is estimated to be relatively slow, the design should be for a reasonable growth rate with sufficient flexibility of sizing of units to ensure efficiency of operation.

c. The plant site must be sufficiently large to permit expansion of the facility to provide for foreseeable future needs, such as increased capacity and higher degrees of treatment.

d. The plant must be designed to facilitate expansion and possible upgrading of the facility.

XIII. Combined Sewerage Systems

The problem of pollution from combined systems shall be considered in early project planning. Possible solutions, both short and long term, shall be outlined in the engineering report. Consideration shall be given to detention facilities and disinfection, separation of combined systems, treatment or control of overflows or other solutions.

B. PREPARATION OF PLANS AND SPECIFICATIONS

The items outlined under Part A, Preliminary Project Planning and Engineering Report, must also be considered when proceeding with final design details. The following guidelines more specifically indicate how these considerations and others are to be applied in the preparation of final contract plans and specifications.

1. Design Summary

A Design Summary, including but not limited to the following items, will be required with submission of final plans and specifications unless acceptable data are already included in the engineering report.

a. A flow diagram indicating the project's major features and the nature of flow and recirculation through the various processes.

b. A hydraulic profile of flow through the treatment plant. This profile should clearly indicate that the peak flow will pass through the treatment facilities without back-up, flooding, or submerging weirs. The hydraulic gradient should permit discharge into the receiving waters during periods of flood stage.

c. Identification of receiving waters and location of point of effluent discharge. This should be shown on a map that would allow transferral to standard U.S.G.S. maps. In addition, detailed information should be provided on the water quality, water uses, and hydraulics of the receiving waters at and near the point of discharge.

d. The initial population, population equivalent, and flow to the facility.

e. Identification, including expected strength and toxicity, of major or significant industrial waste contributions.

f. The design year, design population, and flow.

g. Design efficiency, such as removal of BOD, suspended solids, and other appropriate parameters and the total pounds of BOD, suspended solids, and other significant constituents discharged per day.

h. Physical characteristics of treatment units, including size, surface loadings, and detention times.

i. Identification and justification of any deviations from applicable standards or FWQA Guidelines and Technical Bulletins.

j. Method of ultimate sludge disposal.

k. Identification and explanation of any unusual design features.

II. Reliability

The treatment facility should be capable of satisfactory operation during emergencies, maintenance shutdowns, and power failures. (See Part A, Section VII, page 13.) This type of reliability shall be achieved by consideration and appropriate inclusion of such design factors as:

a. Duplicate sources of electric power.

b. Standby power for essential plant elements.

c. Multiple units and equipment.

d. Holding tanks or basins to provide for emergency storage of overflow and adequate pump-back facilities.

e. Flexibility of piping and pumping facilities to permit rerouting of flows under emergency conditions.

f. Provision for emergency storage or disposal of sludge.

III. Discharges to Shellfish, Potable, or Recreational Waters

Discharges in close proximity to shellfishing beds, public water supply intakes, or contact recreation areas

should be avoided. Where such discharges are unavoidable, special precautions must be taken. In addition to the items listed above, the following are recommended and may be required:

a. Dual chlorination units.

b. Automatic facilities to regulate and record chlorine residuals.

c. Automatic alarm systems to give warning of high water, power failure, or equipment malfunction.

d. Sand filters or polishing ponds following secondary treatment.

IV. Elimination of By-passes and Overflows

a. Plant and up-stream by-passes should not be permitted. (See Part A, Section IX, page 14.)

b. Exceptions, even for combined systems, shall not be considered until every effort has been made to minimize the discharge of untreated waste water to waters by utilizing detention facilities or other alternative means of control or treatment, disinfection of overflows, separation of combined systems, and correction of excessive infiltration.

V. Treatment During Construction

a. If at all possible, by-passing of raw sewage during the construction of additions to existing treatment facilities shall not be allowed.

b. During alterations to existing plants, the same degree of treatment provided by the existing plant should be continued. If this is not feasible, a minimum of primary treatment and disinfection should be provided at all times.

c. The consulting engineer must either establish a construction schedule which will minimize or prevent by-passing or require the contractor to submit such a schedule before construction commences. The requirement for continuous treatment must be clearly stated in the contract plans and specifications.

d. Where no other feasible alternative exists, by-passing may be permitted providing it is kept to an absolute minimum and receives prior approval from the State and FWQA.

e. Measures to be taken for control of erosion at the construction site must be included in the plans and specifications or otherwise provided for by the consulting engineer and/or contractor.

VI. Experimental Processes or Equipment

a. FWQA encourages the application of new approaches to treatment plant design and operation. Aid for the construction and operation of facilities demonstrating experimental processes or equipment is available under the FWQA Research, Development and Demonstration Program.

b. Section 8 P. L. 84-660 grant funds may be used for facilities incorporating new processes or equipment which have had limited prior use, providing the project is reasonable in scope and preliminary results are favorable.

c. In such cases, the contract specifications must include details on performance criteria that are acceptable to the State and FWQA. In some cases, adequate performance guarantees may be required.

d. Prior approval of the State and FWQA must be obtained before preparation of contract plans and specifications for such projects.

VII. Flexibility and Ease of Operation and Maintenance

a. The design of process piping, equipment arrangement, and unit structures in the facility must allow for efficiency and convenience in operation and maintenance and provide maximum flexibility of operation. Such

flexibility should permit the highest possible degree of treatment to be obtained under varying circumstances.

b. Process controls, such as the return and measurement of sludge in the activated sludge process, variable recirculation capacity for trickling filter plants, and the feeding of raw wastes directly into aeration tanks, should be provided.

c. All equipment shall be easily accessible so as to provide ease of maintenance.

d. Adequate facilities shall be provided for taking test samples at required locations.

e. Multiple units or dual compartments with unit drains should be provided for all processes, including disinfection facilities, so that draining, cleaning, and other maintenance can be provided without omitting any treatment process. For small plants retention basins may be substituted for these purposes.

f. All basins and tanks in locations subject to high ground water levels or flooding should be provided with back-flow relief valves.

g. The use of equalization tanks to decrease the impact of peak loads is recommended.

h. Color coding shall be provided to identify each type of process piping in the treatment plant.

i. An adequately designed and equipped laboratory shall be provided.

j. Equipment with high noise levels, such as compressors and centrifuges, shall be enclosed in separate rooms, which should be sufficiently soundproof to protect the operator and to satisfy neighborhood environmental requirements.

k. Instrumentation should be used to facilitate operation and recordkeeping. Flow measurement and recording equipment should be provided at the influent end of the plant.

l. All materials of construction shall be such as to withstand local climatic and other environmental conditions. This is particularly important in coastal areas.

VIII. Protection of Effluent Quality

a. All aspects of plant design, including the layout of tanks and piping, shall allow for routine maintenance of treatment units without deterioration of the plant effluent.

b. The flow from all unit drains must be directed back to the treatment plant and not discharged into the plant effluent.

c. Baffles or other means must be provided across the surface of primary tanks, secondary tanks, and chlorine contact tanks to prevent the discharge of floating materials.

d. All final settling tanks must be provided with skimming devices to collect and remove floating solids.

e. Extended aeration plants must be equipped with sludge holding tanks for wasting excess sludge so as to prevent sludge carryover into the effluent. Polishing lagoons or sand filters are recommended following this type of facility.

f. No piping may be installed which would allow for the direct discharge of sludge solids or ashes into the effluent or receiving waters.

g. Piping should be arranged so that no supernatant, including drainage from sludge beds, centrate, filtrate, overflows from thickening units and digesters, etc., is discharged into the effluent. Supernatant should either be returned to the treatment process or, preferably, be given separate treatment and disposal.

IX. Safety Features

As indicated before, these Guidelines are not intended to be all inclusive. The safety features enumerated below are those which deserve increased emphasis.

a. Chlorine facilities must be provided with proper ventilation and heating. The fan switch shall be located outside of the facility. The chlorine storage area should be separated from the feed area and from the remaining plant areas.

b. The wet wells and dry wells of pumping stations must be provided with positive means of ventilation.

c. The treatment plant shall be enclosed as necessary to protect the public and the facility.

d. Protective railing shall be provided around open tanks and other areas where it may contribute to safety.

e. Explosion-proof motors, controls, and electrical wiring and lighting shall be provided in all hazardous areas, such as the digester control building and enclosed wet wells.

f. The public water supply must be protected to eliminate the possibility of contamination by cross connections with sewage or sludge piping. This should be achieved

by a positive air break, although an adequate automatic flow-back prevention device may be acceptable under certain circumstances. Installation should be on the main water line where it first enters the treatment plant or pumping station and prior to any plant piping connections, including yard hydrants.

g. Flood lights shall be provided for nighttime inspection and maintenance.

h. Signs shall be provided designating hazardous areas and nonpotable water taps.

X. Interceptor Sewers

a. Particular attention shall be given to ensure that sewers will be as water tight as possible. Plans and specifications shall include the following.

1. Infiltration or exfiltration requirements with maximum allowable limits.

2. Bedding and backfill specifications including cross section details.

3. Jointing specifications to provide for minimum infiltration.

4. Requirements for post construction testing to determine compliance with specified limitations on infiltration.

b. Adequate subsurface investigations should be made to identify underground conditions such as the presence of rock or unsuitable soils. The bid proposal should be based on an evaluation of such investigations.

XI. General Requirements

a. The contract specifications must include all FWQA administrative requirements. These include such items as project signs, labor standards, wage rates, civil rights, and competitive bidding. Required subjects and documents can be obtained from the applicable State agency or FWQA Regional Office.

b. Plans and specifications shall be prepared with all necessary details to permit the contractor to properly evaluate the cost of the project and to submit a competitive bid. Details shall be sufficiently clear and complete to avoid the issuance of unnecessary and costly change orders.

c. Those portions of the project that are eligible for Federal aid under P. L. 84-660 must be clearly identified and contained either in separate contracts or in separate bid schedules in the contract documents.

GUIDELINES FOR OPERATION AND MAINTENANCE

A. FEDERAL AND STATE INSPECTIONS

I. To provide assurance of effective, efficient, continuous operation of waste treatment facilities and related appurtenances constructed under PL 84-660 grants within their jurisdiction, State agencies shall establish and maintain appropriate waste treatment facility inspection and correction programs. This activity shall be clearly identified in the annual State Program Plan submitted to FWQA.

II. State agencies shall provide assurance in writing to the Commissioner of FWQA that they will inspect or provide for the inspection of facilities constructed with PL 84-660 funds to determine whether these facilities are operated efficiently and effectively in accordance with plant design. Facilities shall be inspected at least annually for the first three years after completion of construction and periodically thereafter.

a. The inspector shall record the following information:

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1. General information, including: date of inspection; plant identification and location; name of inspector and title; type of plant and collection system; and estimated population served.

2. Plant loading and performance data, including: average daily flow (MGD); peak flow rate for wet and dry weather (MGD); percent daily industrial flow to plant; date, time and volume of any wastes by-passed plant; and summary of laboratory analyses data on raw waste and final effluent and other significant unit processes.

3. Information on operating personnel, including: number and qualifications of personnel in each job category; total manhours per week; number of State certified or licensed personnel; and staffing deficiencies.

4. An identification and brief discussion of any operational problems or difficulties.

5. An evaluation and report on the facility, including: adequacy of operation and plant performance with regard to State and Federal requirements; general housekeeping and maintenance adequacy; testing and reporting adequacy; and recommendations for corrective actions.

6. Appropriate additional operation and maintenance data and information pertinent to the conditions found at the plant or elsewhere in the sewerage system at the time of inspection.

b. Copies of the inspection results shall be distributed by the State water pollution control agency to the subject waste treatment facility, and the FWQA Regional Office.

c. FWQA shall notify each State by January 1 each year of the facilities the State must inspect in order to comply with 18 CFR 601.35. This list shall also identify on a tentative basis those facilities to which FWQA Regional Office representatives may accompany State representatives to conduct inspections. Reasonable advance notice will be given by FWQA to the State on plant inspections not previously indicated on the annual list.

III. In addition to thorough annual inspections for the first three years, as described above, routine interim inspections should be conducted by the State. The FWQA regional office should receive a copy of the inspection reports on interim inspections if they relate to major deficiencies.

IV. Prompt and meaningful followup action shall be taken by the State to assure correction of inadequacies and deficiencies noted at inspections.

a. Where major deficiencies are involved, a copy of any significant official State correspondence, notices, or orders to a municipality and followup inspection reports should be sent to the FWQA Regional Office.

b. Wherever possible, in correcting deficiencies in operation, the State should work with the consulting engineer responsible for the subject facility.

B. PERSONNEL

I. The grantee shall provide a staff of qualified personnel that is adequate to operate the facility efficiently and effectively so as to achieve the highest level of treatment at all times.

a. Qualified personnel shall be those meeting requirements established under State certification programs or other requirements established by the State and Federal governments.

b. The grantee shall pay adequate salaries commensurate with duties, responsibilities and other conditions of employment.

c. The grantee shall provide for such classroom and on-the-job training as is necessary to qualify personnel for the various positions for initial start-up of the waste treatment facility and for operation thereafter.

II. Plant staffing requirements shall be submitted with the plans and specifications and shall include an itemized list of positions and jobs to be established, duties and responsibilities of the positions, and the number of persons to be provided in each of these positions at commencement of plant operation. (See Guidelines for Design, Part A, Section XI, page 15.)

III. Thirty days prior to commencement of operation, the grantee shall provide the State and FWQA an itemized list of the positions filled, the qualifications of those employed, and assurance that the remaining vacant positions will be filled with qualified personnel as necessary for the efficient and effective operation and maintenance of the facility.

IV. The chief operator shall be retained by the grantee by the time the waste treatment plant is fifty percent complete so that he can become familiar with the plant layout, piping, underground utilities and checkout of all equipment.

C. RECORDS, REPORTS, AND LABORATORY CONTROL

I. A permanent record file shall be maintained by the grantee at each of its waste treatment plants or at some appropriate location. The file should include:

a. The operation and maintenance manual for the waste water treatment facility. (See Appendix, page 42.)

b. Planning reports, design criteria and other related data.

c. All plans, specifications, drawings, and manufacturers' specifications and recommendations for operation and maintenance of each unit.

d. Appropriate flow charts indicating the system hydraulics.

II. Complete plant operating records shall be maintained.

a. These records serve to guide plant operating and process control personnel and become the source of historical data on the precise performance of the facility. Plant operating reports can often be standardized, but it is of prime importance that the information and related forms be tailor-made for each operation in order to be effective.

b. It is desirable to routinely file plant operating records with the appropriate State agency. A monthly report of the daily operating record is of assistance to the regulatory agency in carrying out its responsibilities.

III. Adequate monitoring, sampling and analysis of flows is fundamental to good operation and maintenance.

a. The influent should be monitored, sampled and analyzed so as to determine the rate of flow and characteristics of the waste waters to be treated.

b. Appropriate monitoring, sampling, and analysis shall be continued through each process so as to indicate any adjustments necessary to provide a continuously high quality effluent.

c. Wherever possible, the receiving water should be monitored to determine the effect of the plant effluent in relation to water quality standards.

D. PROCESS CONTROL

I. The waste treatment plant should be operated so as to fully and effectively utilize the flexibility in process control provided for in the plant design.

a. Plant flexibility should be used to get the maximum treatment out of the facility on a day-to-day basis. This includes making such process adjustments as may be indicated by the monitoring system.

b. The flexibility in routing flows that is provided in the design shall be used to permit preventive maintenance and repairs to be carried out without by-passing the entire treatment plant.

c. A total plant by-pass shall be used only as a last resort when necessary to protect the health and welfare of operating personnel or to prevent extensive damage to the plant facilities or processes. In those cases where the plant by-pass must be used:

1. Where possible, advanced approval must be obtained from the State. If this is not possible, the State must be notified of the by-pass promptly by telephone.

2. A complete written report shall be filed with the State. This report shall include the date, time, quantity of

the waste, characteristics of the waste, reason for by-passing, steps taken to prevent recurrence of the problem, and any other pertinent information considered necessary by the State.

II. Plant operating personnel must be alert to any trends or changes in the characteristics of the influent, both on a long-range basis and on the short-term basis needed for day-to-day operations.

a. Operators should maintain continuous communication with plant management and appropriate regulatory agencies so that plant inadequacies are detected early, thus affording lead-time to diagnose and resolve problems before they impair quality control in the plant.

b. Provision should be made for warning plant operators promptly of any unusual flows or wastes that are discharged accidentally or otherwise to sewers served by the plant.

III. An effective equipment maintenance program is necessary to ensure that all equipment is kept in a highly reliable operating condition. It is the responsibility of the plant management to provide sufficient funds for maintenance, repairs, spare parts, and standby equipment to keep the plant, pumping stations and related appurtenances operating satisfactorily.

a. The maintenance program should include:

   1. The establishment of a control system which identifies and locates each piece of operating equipment, a description of the maintenance needs, a list of the general procedures for carrying out the job, and appropriate routine maintenance schedules.

   2. A spare-parts inventory to facilitate advance ordering of unit parts vital to the continuous and effective operation of the facility.

b. Plants employing a superintendent should provide a management system for recording equipment maintenance and repairs. This will permit an evaluation of equipment performance and of future maintenance or replacement of a part or unit with one that is more reliable.

c. Preventive maintenance should be commenced immediately upon installation of the equipment and should not be delayed until the facility is placed in operation.

d. When possible, major maintenance jobs and repairs necessitating a shut-down of a unit shall be scheduled when it will have the least effect on waste treatment efficiency and the receiving waters.

APPENDIX

SUGGESTED GUIDE FOR AN OPERATION AND MAINTENANCE MANUAL

FOR WASTE TREATMENT FACILITIES

I. INTRODUCTION

A. Operation and Managerial Responsibility
B. Description of Plant Type and Flow Pattern
C. Percent Efficiency Expected and How Plant Should Operate
D. Principal Design Criteria

II. PROCESS DESCRIPTION

(Function, relation to other plant units, schematic diagrams)

A. Pumping
B. Screening and Comminution
C. Grit Removal
D. Sedimentation (Primary)
E. Aeration and Reaeration
F. Sedimentation (Secondary)
G. Trickling Filters
H. Sand Filters
I. Sludge Digestion
J. Sludge Conditioning
K. Sludge Disposal
L. Gas Control and Use
M. Disinfection
N. By-Pass Controls and Excess Flow Treatment Facilities
O. Waste Stabilization Lagoons
P. Other

III. DETAILED OPERATION AND CONTROLS

(Routine, alternate, emergency, description of various controls, recommended settings, reference to schematic diagrams, failsafe features)

A. Manual
B. Automatic
C. Physical
D. Chemical
E. Biological (including Bacteriological)

F. Industrial Wastes Monitoring
G. Safety Features
H. Problems, Causes, and Cures

IV. LABORATORY CONTROLS

(What and why tests are made, interpretation of results, and how samples are obtained)

A. For Each Process Description Given Above

1. Sampling
2. Flow Controls
3. Analysis

B. Monitoring of Effluent and Receiving Waters
C. Water Quality Standards

V. RECORDS

(Importance of records, graphing test results, example and sample forms)

A. Process Operations
B. Laboratory
C. Reports to be Submitted to State Agencies
D. Maintenance
E. Operating Costs

VI. MAINTENANCE

(Schedule--daily, weekly, monthly, etc., reference to pages in manufacturers' manuals)

A. Manufacturers' Recommendations
B. Preventative Maintenance Summary Schedule
C. Special Tools and Equipment
D. Housekeeping Schedule

VII. SAFETY

A. Sewers
B. Electrical Equipment
C. Mechanical Equipment
D. Explosion and Fire Hazards
E. Health Hazards
F. Chlorine Handling
G. Aeration Tank Hazards
H. Recommended Safety Equipment

VIII. UTILITIES

(Source, reliability, cost)

A. Electrical
B. Gas
C. Water
D. Heat

IX. PERSONNEL

(Detail of job requirements, task plan estimating man-hours per month and year)

A. Manpower Requirements
B. Qualifications and Background
C. Certifications
D. Administration and Supervision
E. Laboratory

X. APPENDIX

A. Schematics
B. Valve Indices
C. Sample Forms
D. Chemicals Used in Plant
E. Chemicals Used in Laboratory
F. Water Quality Standards
G. Detailed Design Criteria
H. Equipment Suppliers
I. Suppliers' Manuals
(May be bound separately)

J. Infiltration Controls (Ordinances)
K. Industrial Waste Controls (Ordinances)

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